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# FOSSIL HARES FROM THE LATE PLIOCENE OF SOUTHERN IDAHO

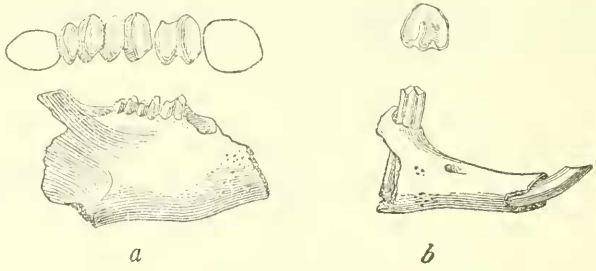
By C. Lewis Gazin

*Assistant Curator, Division of Vertebrate Palcontology, United States National Museum*

Among the fossil remains of late Pliocene mammals from lake deposits near Hagerman in southern Idaho are a number of specimens representing leporid types. Three distinct species are recognized, two of which are referred to the genus *Hypolagus*. The third may represent *Alilepus*, a lagomorph previously known from the Neocene of Asia. Comprising the material are a well-preserved skull with the atlas and right ramus of the mandible associated, four fragmentary jaws, an assortment of isolated teeth, and a few limb bones. The greater part of the National Museum material was collected by Elmer Cook, of Hagerman, from various localities south of the *Plesippus shoshonensis* quarry. A few specimens, however, including the *Alilepus*? jaw, were encountered in the quarry during operations there by Smithsonian Institution parties.

A third species of *Hypolagus* is represented in collections made by an expedition from the California Institute of Technology at a locality near Grand View in southwestern Idaho. The fauna from Grand View is not identical with that from Hagerman, and although the difference may be attributed to the geographic separation of the localities, it seems likely that the two are of slightly different age. Presumably, the Grand View occurrence is of later date. The Grand View lagomorph material was loaned to me for study through the kindness of Dr. Chester Stock.

Upper Pliocene lagomorphs are relatively little known, and heretofore the occurrence of these forms in the Idaho beds has not been recorded. The number of species here recognized is noteworthy, a diversity approaching that of the rabbits and hares now living in southern Idaho. The recent fauna in the vicinity of Hagerman includes the white-tailed and black-tailed jack rabbits (*Lepus townsendii townsendii* and *L. californicus deserticola*), the sage cottontail (*Sylvilagus nuttalli grangeri*), and the pigmy rabbit (*Brachylagus idahoensis*). To the north, in the mountainous portion of the State, are found the snow-shoe rabbit (*Lepus bairdii bairdii*) and the pika (*Ochotona princeps lemhi*). A second pika (*Ochotona schisticeps goldmani*) is recorded from the lava beds to the northeast of Hagerman. A marked diversity of lagomorphs is also found to the south in the Basin and Range province.



*a* *b*

FIGURE 1.—*Hypolagus*, near *vetus* (Kellogg): *a*, Fragment of right ramus of mandible (U.S.N.M. no. 12620); *b*, fragment of right ramus of mandible (U.S.N.M. no. 12621). Lateral views × 1, occlusal views × 2. Hagerman lake beds, Upper Pliocene, Idaho.

Drawings for all the figures herein were made by Sydney Prentice.

### HYPOLAGUS, near VETUS (Kellogg)[1]

FIGURE 1

Three fragmentary mandibles, a number of isolated teeth, and a few limb bones from the vicinity of Hagerman, Idaho, are recognized as belonging to a species near, or possibly identical with, *Hypolagus vetus*. *H. vetus* is the type species and was originally described from the Pliocene beds at Thousand Creek in northwestern Nevada. It appears likely that the Hagerman material is specifically distinct from the form occurring in the earlier Pliocene beds of Nevada, but the few differences observed in the incomplete material at hand do not warrant recognizing a distinct form.

[1] Kellogg, L., Univ. California Publ. Bull. Dept. Geol., vol. 5, pp. 436–437, 1910; see also Dice, L. R., Univ. California Publ. Bull. Dept. Geol., vol. 10, pp. 181–182, 1917.

Comparison between the Hagerman specimens and topotype material of *H. vetus* in the collections of the California Institute of Technology shows the Idaho form to be very nearly the same size as *H. vetus*, comparable in this respect with specimens of *Lepus townsendii*. Two of the jaw portions appear to be somewhat more robust than in *H. vetus* and in U.S.N.M. no. 12620 (fig. 1*a*); the lower tooth row is slightly longer and the individual teeth relatively a little wider. Moreover, several of the third lower premolars, though similar in pattern to those of *H. vetus*, are a little larger and somewhat more rounded anterointernally, giving the anterior portion of the tooth a relatively greater width. Two isolated $P^2$ from near Hagerman show a deep anterior reentrant enamel fold directed postero-externally and a much shallower groove external to this, much as in *H. vetus*. The upper molariform teeth are similar to those in the Nevada specimens.

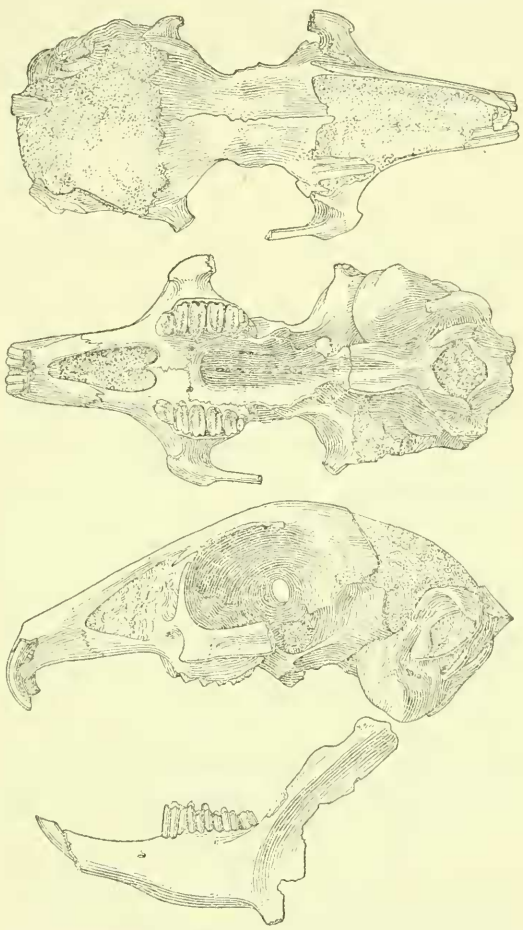


FIGURE 2.—*Hypolagus limnetus*, new species: Skull and mandible, type specimen (U.S.N.M. no. 12619); dorsal, ventral, and lateral views of skull and lateral view of right ramus (reversed) of mandible; × 1. Hagerman lake beds, Upper Pliocene, Idaho.

The Hagerman form appears somewhat more advanced than the Thousand Creek *Hypolagus vetus*, as suggested by the slightly greater relative width of the lower teeth in one of the jaws and perhaps by the greater average robustness of the jaws of the Idaho form. In all probability a single line of descent is represented, the Middle Pliocene form in Nevada giving rise to the larger of the late Plio-

cene types occurring at Hagerman. As to whether this line led to any of the large species of *Lepus* there is no certainty. As yet no types have been described from the Pliocene or Pleistocene of North America clearly bridging the seemingly trivial, yet apparently persistent, dental characters cited by Dice as distinguishing *Hypolagus* from *Lepus* and *Sylvilagus*. Moreover, it is interesting to note that fossil materials recognized as including both *Hypolagus* and *Lepus* have been found in an early Pleistocene occurrence at Anita, Ariz.[2]

### HYPOLAGUS LIMNETUS, new species

FIGURES 2, 3

*Type.*—Skull, right ramus of mandible, and atlas, U.S.N.M. no. 12619.

*Locality.*—T. 7 S., R. 13 E., about 2 miles south of the *Plesippus* quarry, near Hagerman, Idaho.

*Horizon.*—Hagerman lake beds.

*Specific characters.*—Size near that of *Sylvilagus nuttalli grangeri*, much smaller than *Hypolagus vetus*. Rostrum relatively short and cranial portion elongate. Cranium shallower posteriorly and less depressed with respect to the rostrum than in *S. nuttalli grangeri*. Posterior nasal opening dorsoventrally deep and transversely constricted. Bullae very large. Basi-occipital narrow and elongate. Teeth about equal in size to those of *S. nuttalli grangeri*. Anterior upper incisors strongly recurved with anterior groove more nearly median in position. $P^2$ with two unequal reentrant folds and $P_3$ with anterior external reentrant fold relatively deep.

*Material.*—The skull (fig. 2) belonging to the type is remarkably well preserved and includes the entire dentition. However, the specimen lacks the nasals, parietals, the left and part of the right zygoma, and the right bulla. The atlas and greater portion of the right ramus of the mandible were found in position with the skull, the ramus incomplete only in the region of the angle. In addition to the type a few isolated teeth and some fragments of limb bones are recognized as belonging to this species.

*Description.*—In size *Hypolagus limnetus* is only slightly smaller than the sage cottontail (*Sylvilagus nuttalli grangeri*) now living on the Snake River Plains, although considerably larger than the pigmy rabbit (*Brachylagus idahoensis*). Compared with the sage cottontail the fossil skull has a relatively shorter rostrum and an anteroposteriorly longer basicranial region. The cranial portion of the skull is not so depressed posteriorly, and the supra-occipital is dis-

[2] Hay, O. P., Proc. U. S. Nat. Mus., vol. 59, pp. 628–631, 1921; see also Dice, L. R., Papers Michigan Acad. Sci., Arts, and Letters, vol. 16, pp. 379–382, figs. 8–11, 1932.

tinctly shorter dorsoventrally. The tympanic bulla is of considerable size, much larger than in *S. nuttalli grangeri* and nearly as large relatively as in *B. idahoensis*. The space between the bullae is less than in the cottontail and the basi-occipital is about one-fourth longer. The ectopterygoid fossae are about the same distance posterior to the cheek teeth as in *S. nuttalli grangeri* but much farther forward from the foramen magnum, apparently because of the greater inflation of the bullae. The posterior nasal opening is relatively deep and distinctly narrower transversely than in *Sylvilagus*, much as in *Romerolagus*. The palatines form a more distinct ledge or ridge inward from the posterior molars on each side than in *Sylvilagus*. The palatines on either side of the nasal opening are nearly parallel in the fossil, whereas in *Sylvilagus* the widest portion of the opening is to the front, converging posteriorly. The bony palate between the grinding teeth is short as in *Sylvilagus*, the palatal processes of the palatines being more reduced than in *Romerolagus*. Only a part of the right jugal is preserved in the fossil, but this portion is a little deeper than in *S. nuttalli grangeri*, and anteriorly the outward flare of the ventral surface is less pronounced. The postorbital processes are broken away, but on both sides the length of the break is short, suggesting that the process consisted only of a backward-projecting spur.

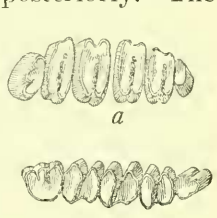


FIGURE 3. — *Hypolagus limnetus*, new species: *a*, Left superior dentition; *b*, right inferior dentition; type specimen (U.S.N.M. no. 12619); occlusal views, × 2. Hagerman lake beds, Upper Pliocene, Idaho.

The upper teeth in the fossil are nearly identical in size with those in *Sylvilagus nuttalli grangeri*, although the diastema between the incisors and cheek teeth is much shorter. The principal incisors are more recurved than in the cottontail, and the groove on the anterior surface is more nearly median in position. The small posterior incisors show no differences other than being directed backward to a greater degree. The enamel pattern of $P^2$ (fig. 3*a*) differs from that in the recent Idaho cottontail in having only two reentrant folds on the anterior surface. Both folds are relatively shallow, the more lingual fold being the deeper. In *S. nuttalli grangeri* there are three distinct anterior folds, the middle fold being deeper than the others, and in addition there is a very shallow groove near the external margin. The succeeding molariform teeth in the fossil resemble very closely those in the cottontail. The crenulated medial lingual folds in these teeth extend almost as far externally as in *S. nuttalli grangeri*.

The mandible shows about the same proportions as in *Sylvilagus nuttalli grangeri*, although the diastema between the incisor

and $P_3$ is a little shorter and the anterior surface of the ascending ramus rises more steeply, placing the condyle slightly higher and a little farther forward than in the living rabbit.

As is true in the upper dentition, the size of the lower teeth can be closely matched in specimens of *Sylvilagus nuttalli grangeri*. The lower incisor shows a longer bevel, apparently accompanied by a slightly more acute cutting edge; also the posterior surface of the incisor does not show the slight longitudinal concavity or groove commonly present in *S. nuttalli grangeri*. $P_3$ (fig. 3*b*) shows the pattern typical of *Hypolagus* in which the posterior of the two external reentrant folds extends only about halfway across the tooth, there being no reentrant from the internal surface. The anterior external fold, however, appears more deeply impressed than is usual in *Hypolagus*. In *Sylvilagus* and *Lepus* the posterior external reentrant fold extends nearly or entirely to the internal surface of the tooth, and the anterior surface of the anterior column is commonly complicated by one or more shallow reentrant folds or grooves. The molariform lower cheek teeth of the fossil show no important characters distinguishing them from these teeth in the sage cottontail of Idaho.

*Comparison.—Hypolagus limnetus* is distinctly smaller and less robust than *Hypolagus vetus*, or the large Hagerman form close to *H. vetus*. The lower jaw is slenderer, shallower, and has teeth about one-fourth smaller. The two enamel folds on the anterior surface of $P^2$ are much shallower at the stage of wear observed than in *H. vetus*, whereas the lingual reentrant folds on the upper molariform teeth appear somewhat more deeply impressed; also the anterior external fold on $P_3$ appears to be deeper than in *H. vetus*.

*Hypolagus edensis* Frick,[3] from the Eden Pliocene beds in southern California, is apparently somewhat smaller than *H. limnetus*. The anterior external enamel fold of $P_3$ in *H. edensis* appears rather deep, but is placed more nearly on the anterior surface of the tooth. Also, the figures of the lower molariform teeth show them to be more rounded internally than in *H. limnetus*.

*Hypolagus browni* (Hay)[4] from the early Pleistocene occurrence at Anita, Coconino County, Ariz., is a small species, intermediate in size between *Hypolagus limnetus* and *Brachylagus idahoensis*. The anterior portion of a skull, U.S.N.M. no. 10197, of *H. browni* shows few differences other than that of size from the skull of *H. limnetus*. The upper molariform teeth in the two species are similar, although the median fold in each of the teeth appears somewhat more crenulated in *H. limnetus*. The lower jaw of *H. browni* is distinctive in that the ascending ramus rises much less steeply than in *H.*

[3] Frick, Childs, Univ. California Publ. Bull. Dept. Geol., vol. 12, p. 348, figs. 52, 53, 1921.
[4] Hay, O. P., *op. cit.*, pp. 630, 631, 1921; also Dice L. R., *op. cit.*, 1932.

*limnetus*, and the condyle is considerably lower and somewhat more posterior in position. The first cheek tooth of *H. browni* is rather distinctive and apparently shows some variation in the enamel pattern between specimens. In three lower jaws the posterior external fold in $P_3$ extends slightly more than halfway across the tooth and near its inner extremity shows one to three plications. A fourth specimen, that figured by Dice, shows an enamel lake near the lingual side of $P_3$, opposite the posterior external fold.

There is in the Anita collection a jaw portion exhibiting all cheek teeth except $M_3$, a specimen not examined by Hay or by Dice since the matrix has only just been removed. The jaw corresponds closely in size with those recognized as *Hypolagus browni*, but $P_3$ is a little larger and the posterior reentrant fold extends completely across the tooth and is open internally. A short distance below the occlusal surface, however, this fold is cut off internally. Also, there is present a slight groove on the anterior surface. This specimen may represent a species of *Sylvilagus* or *Lepus*, or possibly represent an extreme variant of *H. browni* in which the teeth are perhaps at an earlier stage of wear than in other specimens.

The lepores from the Miocene are in general of a more primitive type than the Thousand Creek *Hypolagus vetus* and show a closer approximation to the conditions seen in the John Day *Archaeolagus ennisianus*. Species in this category include *Archaeolagus? macrocephalus* (Matthew)[5] and *Archaeolagus? primigenius* (Matthew) from the Upper Rosebud of South Dakota and *Hypolagus? apachensis* Gazin[6] from the Upper Miocene of southern California. Illustrations and measurements for the types from the Rosebud were given by E. R. Hall[7] incidental to a description of the rabbit material from the later Tertiary at Fish Valley, Nev.

*Remarks.*—The skull of *Hypolagus limnetus* is decidedly modern in appearance but has retained to a certain degree many of the primitive characters observed in *Palaeolagus*. Several of those characters in which the Hagerman form differs from modern *Sylvilagus* and *Lepus* are suggestive of conditions more conspicuous in the Oligocene rabbits. These include the shorter rostrum; less depressed cranium, which is associated with a smaller angle between the basifacial and basicranial axes; large, less widely separated bullae; anteroposteriorly elongate basioccipital; a more constricted posterior nasal passage; deeper zygomatic arches; and presumably simpler postorbital processes. The dentition of *H. limnetus* is quite removed from that in *Palaeolagus* but may well have been derived from the latter through such forms as *Archaeolagus ennisianus*.

[5] Matthew, W. D., Bull. Amer. Mus. Nat. Hist., vol. 23, pp. 214–216, 1907; vol. 50, pp. 86–87, 1924.

[6] Gazin, C. L., Carnegie Inst. Washington Publ. 404, pp. 67–69, pl. 3, figs. 1–4, 1930.

[7] Hall, E. R., Univ. California Publ. Bull. Dept. Geol., vol. 19, pp. 308–311, figs. 25–28, 1930.

HYPOLAGUS FURLONGI, new species

FIGURE 4

*Type.*—Right ramus of mandible with incisor and $P_3$ to $M_2$ inclusive, Calif. Inst. Techn. Coll. Vert. Pal. no. 1321.

*Locality.*—Near Grand View, Idaho.

*Formation.*—Idaho formation?

*Specific characters.*—Size about equal to *Hypolagus limnetus*. Mandible of less depth and diastema between I and $P_3$ shorter but with upper and lower teeth approximately as large in *H. limnetus*. $P^2$ with deep crenulated reentrant fold on anterior surface and a shallow antero-external groove. $P_3$ triangular in in outline with antero-external fold shallow.

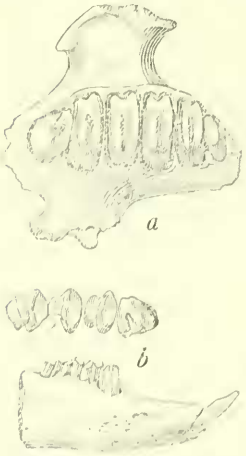



FIGURE 4.—*Hypolagus furlongi*, new species: *a*, Left maxilla with superior dentition (C.I.T. no. 1325), occlusal view, × 2; *b*, right ramus of mandible, type specimen (C.I.T. no. 1321), lateral view × 1, occlusal view × 2. Grand View, Idaho.

*Material.*—The California Institute of Technology collection of lagomorph remains from near Grand View, Idaho, includes four fragmentary mandibles, no. 1321 to no. 1324, inclusive, exhibiting one to four cheek teeth each. The type, no. 1321 (fig. 4*b*), includes also the incisor, but in this specimen $P_4$ and $M_1$ are not so complete as in no. 1322. A left maxillary portion, no. 1325 (fig. 4*a*), referred to this species includes the entire cheek tooth series. In addition to these there are several more incomplete maxillary and jaw portions and a number of isolated teeth.

*Description.*—The Grand View lagomorph approaches closely in size the small rabbit *Hypolagus limnetus*, from Hagerman. The maxillary portion equals in size and markedly resembles that of *H. limnetus*. However the first upper cheek tooth exhibits a deeper reentrant fold on the anterior face, which is in addition distinctly crenulated. External to this fold is a slight groove, which is somewhat shallower than in *H. limnetus*. The remaining upper cheek teeth of *Hypolagus furlongi* apparently cannot be distinguished from those in the Hagerman form.

The depth of the lower jaws of *Hypolagus furlongi* is a little less than in *H. limnetus*, and the diastema between the incisor and $P_3$ is appreciably shorter although the cheek teeth are about as large. $P_3$ appears distinct from that in *H. limnetus* in being markedly triangular in outline as viewed from above. The postero-internal angle of this tooth is somewhat more acute. The posterior external reen-

trant fold shows no differences, but the anterior external fold appears a little shallower. Moreover, one of the isolated $P_3$ and this tooth in no. 1322 show a slight groove on the anterior face. No differences were observed between the species in the lower molariform teeth.

The species *Hypolagus limnetus* and *Hypolagus furlongi* are very close and the differences separating them may be only of geographic importance, but probably the deposits in which remains of the two were found are of slightly different age as indicated by the specific differences observed between the otters[8] and some of the rodents.[9] In these cases the Grand View stage appears somewhat more advanced.

### ALILEPUS? VAGUS, new species

FIGURE 5

*Type.*—The anterior portion of a right mandibular ramus including $P_3$, U.S.N.M. no. 12622.

*Locality.*—T. 7 S., R. 13 E., *Plesippus* quarry, near Hagerman, Idaho.

*Horizon.*—Hagerman lake beds.

*Specific characters.*—Size near that of *Hypolagus vetus*, somewhat smaller than *Alilepus annectens* (Schlosser). Portion of jaw between I and $P_3$ relatively short and heavy. Outward deflection of inferior margin of ramus, just anterior to lower end of $P_3$, somewhat sharper than in *H. vetus*. I and $P_3$ relatively large. $P_3$ with posterior external reentrant fold extending about halfway across tooth and internal fold reaching slightly less than halfway. Anterior external reentrant fold shallow and rounded.

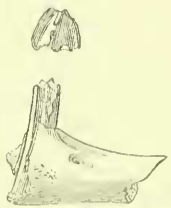


FIGURE 5.—*Alilepus? vagus*, new species: Fragment of right ramus of mandible, type specimen (U.S.N.M. no. 12622); lateral view × 1, occlusal view × 2. Hagerman lake beds, Upper Pliocene, Idaho.

*Description.*—The only specimen exhibiting the peculiar character suggesting an alliance with Schlosser's *Lepus annectens*[10] from the latter Tertiary of Mongolia is a single fragmentary ramus (fig. 5) with the third premolar and the basal portion of the incisor. The specimen corresponds very closely in size with the large *Hypolagus* jaws from Hagerman but shows several features indicating it to be a distinct type. The jaw portion anterior to $P_3$ is short and moderately robust, accommodating a particularly broad incisor. The mental foramen is of good size and is placed well out on the external surface of the jaw. The inferior margin of the

[8] Gazin, C. L., Journ. Mamm., vol. 15, no. 2, pp. 137–149, 1934.
[9] Wilson, R. W., Carnegie Inst. Washington Publ. 440, pp. 119–135, 1933.
[10] Schlosser, Max, Pal. Sinica, ser. C, vol. 1, fasc. 1, pp. 45–48, figs. 37–38, 1924.

jaw and the lower part of the lingual surface turn outward just anterior to $P_3$ somewhat more sharply than in *Hypolagus vetus*. Compared with specimens of *Lepus townsendii* having a $P_3$ of about the same size, the anterior portion of the *Alilepus? vagus* jaw is much shorter, deeper anteriorly, and exhibits the base of a distinctly broader incisor.

Presumably, the most distinctive feature is the enamel pattern of $P_3$, which exhibits in addition to the two external reentrant folds seen in *Hypolagus* a deep internal fold extending nearly to the posterior external fold. The heavy enamel of the anterior portion of the internal fold forms with the anterior portion of the posterior external fold a prominent, but discontinuous, transverse ridge on the occlusal surface. The posterior external fold extends about halfway across the tooth and near its inner extremity shows a slight flexure. The anterior external reentrant fold is moderately shallow and rounded internally. The anterior column of $P_3$ is more nearly triangular in cross section than this portion of $P_3$ in the Hagerman *Hypolagus* material.

*Alilepus? vagus*, as indicated by the enamel pattern of $P_3$, appears to be related to the species *Lepus annectens* Schlosser, which Dice [11] has made the type of *Alilepus*, from the Upper Miocene or Pliocene of northern China and Mongolia. The Idaho form is somewhat smaller, judged by the measurements given by Schlosser and by Young,[12] and the antero-external angle of $P^3$ is sharper and more outstanding. In the figure given by Young for the specimen from northern China the external reentrant folds in $P_3$ appear much less deeply impressed than in the Idaho specimen.

The small rabbit *Romerolagus diazi*, now living on some high mountain peaks in Mexico, exhibits an internal reentrant fold on $P_3$. In this type the internal fold is much constricted or closed at the lingual surface of the tooth, and the posterior portion of the fold is finely crenulated, as are the anterior surfaces of the posterior columns of $P_4$ to $M_2$, inclusive.

It is possible that *Alilepus? vagus* was derived from the Asiatic group. A wide distribution for this genus would not be unexpected considering the presence in the living fauna of North America of the unique *Romerolagus*, the relations of which may be closer to such forms as *Alilepus* than to *Lepus* and *Sylvilagus*. However, whether phylogenetic speculations are warranted by the implications of the pattern of $P_3$ remains to be demonstrated.

[11] Dice, L. R., Journ. Mamm., vol. 12, no. 2, p. 159, 1931.
[12] Young, C. C., Pal. Sinica, ser. C, vol. 5, fasc. 3, pp. 62–63, pl. 3, figs. 12, 13, 1927.

TABLE 1.—*Measurements (in millimeters) of skull and superior dentition*

| Measurement | *Hypolagus limnetus* | *Hypolagus furlongi* |
|---|---|---|
| | U.S.N.M. no. 12619 (type) | C.I.T. no. 1325 |
| Length of skull from anterior surface of incisors to supra-occipital | [1] 67.0 | |
| Length of skull from anterior surface of incisors to inferior margin of foramen magnum | 55.7 | |
| Distance from anterior surface of incisors to bony palate | 21.0 | |
| Length of anterior palatine foramina | 15.5 | |
| Greatest width across anterior palatine foramina | 6.3 | |
| Least anteroposterior length of bony palate | 5.5 | |
| Distance from posterior margin of bony palate to posterior margin of basisphenoid | 20.4 | |
| Width of posterior narial passage immediately posterior to bony palate | 4.5 | |
| Distance from anterior margin of basi-occipital to foramen magnum | 10.1 | |
| Anteroposterior diameter of tympanic bulla | 13.3 | |
| Greatest transverse diameter of tympanic bulla | 10.5 | |
| Distance between bullae | 7.0 | |
| Distance from dorsal surface of supra-occipital to superior margin of foramen magnum | [1] 6.0 | |
| Greatest width across occipital condyles | 12.5 | |
| Width across postorbital constriction | 10.8 | |
| Depth of anterior portion of zygomatic arch | 5.8 | |
| Greatest width across anteroventral prominences of zygomatic arches | 30.7 | |
| Length of diastema between alveoli of $I^2$ and $P^2$ | 17.1 | |
| Length of cheek tooth series, $P^2$ to $M^3$, inclusive, measured at occlusal surface | 10.7 | 11.3 |
| Length of cheek tooth series measured along alveoli | 12.1 | 12.6 |
| $I^1$, anteroposterior diameter | 1.7 | |
| $I^1$, transverse diameter | 2.3 | |
| $P^2$, anteroposterior diameter | [1] 1.4 | 1.6 |
| $P^2$, transverse diameter | 2.6 | 2.7 |
| $P^4$, anteroposterior diameter | 2.0 | 2.0 |
| $P^4$, transverse diameter at occlusal surface | 4.0 | 4.1 |
| $M^3$, anteroposterior diameter | 0.9 | 1.0 |
| $M^3$, transverse diameter | 1.4 | 1.6 |

[1] Approximate.

TABLE 2.—*Measurements (in millimeters) of mandible and inferior dentition*

| Measurement | *Hypolagus limnetus*, U.S.N.M. no. 12619 (type) | *Hypolagus furlongi*, C.I.T. no. 1321 (type) | *Hypolagus*, near *vetus* | | *Alilepus? vagus*, U.S.N.M. no. 12622 (type) |
|---|---|---|---|---|---|
| | | | U.S.N.M. no. 12620 | U.S.N.M. no. 12621 | |
| Depth of mandible below $M_1$, measured on inner side | 11.4 | 10.6 | 14.8 | | |
| Thickness of mandible below $M_1$ | 4.3 | 4.2 | 5.7 | | |
| Length of diastema between I and $P_3$ | 13.0 | 11.0 | | 17.0 | 15.2 |
| Length of cheek tooth series, $P_3$ to $M_3$, inclusive, measured at occlusal surface | 11.6 | | | | |
| Length of cheek tooth series, measured along alveoli | 12.9 | | 18.0 | | |
| I, anteroposterior diameter | 2.1 | 1.9 | | 2.5 | [1] 3.0 |
| I, transverse diameter | 2.3 | 2.2 | | 3.0 | [1] 3.7 |
| $P_3$, anteroposterior diameter | 2.7 | 2.5 | | 3.3 | 3.5 |
| $P_3$, transverse diameter | 2.3 | 2.4 | | 3.0 | 3.2 |
| $M_1$, anteroposterior diameter | 2.4 | 2.2 | 3.0 | | |
| $M_1$, transverse diameter | 2.7 | 2.6 | 3.5 | | |
| $M_3$, anteroposterior diameter | 1.8 | | | | |
| $M_3$, transverse diameter | 1.7 | | | | |

[1] Approximate.

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